Please replace the specification as follows:

METHOD FOR FORWARDING MULTICAST MESSAGE IN NETWORK COMMUNICATION

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the field of network communication technologies, more particularly to a method for forwarding multicast message in network communication.

2. Background of the Invention

With the large-scale use of meeting TV and development of IPv6, the multicast technology has been used more and more popularly. ~~Forwarding multicast~~ Multicast message forwarding is usually realized by IGMP (Internet Group Management Protocol) in combination with multicast routing protocol. The concrete method is to run the multicast routing protocol on every router in the multicast network, the multicast routing protocol can be any of DVMRP (Distance Vector Multicast Routing Protocol), PIM-DM (Protocol-Independent Multicast — Dense Mode), CBT (Core Broadcast Tree) or PIM-SM (Protocol-Independent Multicast — Sparse Mode). For the routers on the domain boundary and hosts that are required to join the multicast group, IGMP also has to be run. The host sends a request of joining the multicast group through IGMP, and the router connected to the host joins corresponding port of the host to a responding multicast group after receiving the request. Inside the multicast network, the multicast routing protocol forms the multicast forwarding routing ~~list~~table according to topology of the interface joining the multicast group. When the source port sends a message whose destination address is a multicast IP address to the multicast network, the router in multicast network

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forwards it according to the multicast routing ~~list~~table formed by the multicast routing

protocol. After the message has been forwarded to the router connected to the host, the

router sends the message in multicast mode to the interface where the host is connected.

In the network as shown in Fig.1, the multicast source (Source) connects to the

multicast network through Router1. Router1, through domain formed by ~~lots~~a plurality of

routers, connects to Router2 on the domain boundary. Router 2 connects to the host PC1

through Ethernet and the host PC2 is also in Ethernet. In order to correctly forward the

multicast message from Source to PC1, the traditional method needs at least the following

configuration: a kind of multicast routing protocol in dense or sparse mode has to be run on

every router in the multicast network; router-side ~~where which~~application of IGMP is run

on the routers (Router2, Router3) on the domain boundary in the multicast network;

client-side application of~~where~~ IGMP is run on the host ~~applying~~requiring multicast.

After configuring as above, in order to forward the multicast messages normally, it

also need the multicast routing protocol messages, transferring multicast routing

information, transferred regularly between the routers in the multicast network, as well as

the regular report message and the join/leave message in the ~~notice~~announce state between

the routers on the domain boundary and the host. As is shown in Fig.1, first, PC1 sends the

join message to Router2 for applying for joining in the multicast group, Router2 joins the

Ethernet interface that PC1 corresponds to in the multicast group, and the join message

propagates in the whole multicast network through multicast routing protocol messages,

and forms the multicast routing information which can be used to send the message to the

~~carrier~~bearer multicast message interface. In this way, when Source sends a multicast

message meeting requirements through Router1, the forwarded messages through the multicast network are sent to Router2 on the domain boundary, and Router2 sends the multicast message to the Ethernet interface connected to PC1, which receives the message.

Seen from conventional technical scheme, conventional multicast routing forwarding method has the following questionsproblems: first, it lowers the security of IP message, the security is not very high originally. When the router sends the a multicast message to the used host, IGMP sends message from the interface in multicast mode, while in broadcast-type networks (such as Ethernet), this sending mode will cause the problem that the message is sent to the host which should not receive it originally. As is shown in Fig.1, host PC2 can also receive the multicast message proposed intended for PC1. This mechanism sometimes restrains the application of multicast to a great extent. Second, the inconvenience of the traditional method is expressed bylies further in the fact that the network configuration is quite troublesome, there are various configurations for the purposes of hosts, routers on the boundary and forwarding routers and it involves client-side application and the router-side application of the multicast routing protocol and IGMP, demanding a higher qualification from the network administrator. Third, running the multicast routing protocol on all routers will affect the forwarding efficiency of the routers and increase the burden on the routers and hosts in the multicast network. Fourth, a great deal of multicast protocol messages generated between routers and between hosts and routers in the multicast network occupy precious bandwidth resource.

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SUMMARY OF THE INVENTION

Object of the present invention is to provide a method of forwarding multicast message in network communication, which guarantees the security in multicast message forwarding, makes configuration of the multicast network ~~more~~-simpler, saves bandwidth resource and increases forwarding efficiency of the routers.

The object of the present invention is realized as the following ~~steps:~~. ~~said~~ Said method of forwarding multicast message in network communication, comprises:

a. ~~configure~~ establish forwarding match condition at the ~~entry~~ingress interface ~~to~~ of the network device ~~requiring~~ required to forwarding multicast message, the forwarding match condition ~~regulat~~specifies forwarding rule for the multicast message;

b. ~~match~~compare the multicast message to be forwarded to network device through the interface with the forwarding match condition;

c. forward the multicast message according to the ~~matching~~comparing result.

Said forwarding match condition is a multicast message forwarding rule group consisting of more than one multicast message forwarding rule.

Said step b comprises:

b1. determine whether the message entering through this interface is a multicast message;

b2. if the message entering through this interface is a multicast message~~yes~~, ~~match~~compare the multicast message with individual multicast message forwarding rule contained in the forwarding match condition;

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b3. if <u>the message entering through this interface is not a multicast message</u>~~no~~, forward the message in ~~single broadcast~~<u>unicast</u> mode.

In said step b2: ~~match~~<u>compare</u> the source address information in the multicast message with the source address information in the multicast message forwarding rule.

In said step b2: ~~match~~<u>compare</u> the source address and destination address information in the multicast message with the source address and destination address information in the multicast message forwarding rule.

In said step b2: ~~match~~<u>compare</u> the ~~entry~~<u>ingress</u> interface information in the multicast message with the ~~entry~~<u>ingress</u> interface information in the multicast message forwarding rule.

Said step b2 comprises:

b21. determine whether the<u>re is a</u> multicast message forwarding rule ~~is~~ ~~configured~~<u>established</u> at the interface of the network device;

b22. if <u>there is a multicast message forwarding rule established at the interface of the network device</u>~~yes~~, ~~match~~<u>compare</u> the information carried by the multicast message with corresponding information in the multicast message forwarding rule;

b23. if no<u> multicast message forwarding rule is established at the interface of the network device</u>, forward the multicast message according to the multicast routing forwarding ~~list~~<u>table</u>.

Said step c comprises:

c1. determine whether there is <u>a </u>multicast message forwarding rule matching ~~with ~~the information carried by the multicast message in the forwarding match condition;

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c2. if there is a multicast message forwarding rule matching the information carried by the multicast message in the forwarding match conditionyes, forward the multicast message according to the multicast message forwarding rule;

c3. if no multicast message forwarding rule in the forwarding match condition matches the information carried by the multicast message, forward the multicast message according to the multicast routing forwarding listtable.

In said step c2:

c21. determine whether the message forwarding destination configuredspecified in the multicast message forwarding rule is the-a forwarding exitegress interface or the-a next hop address;

c22. if the destination is the-a forwarding exitegress interface, and for-if the message is configured with lotsa plurality of forwarding exitegress interfaces, the message is forwarded to all the forwarding egress interfaces after copied;

c23. if the destination is the-a next hop address, forward the message according to the single broadcastunicast routing forwarding listtable and for-if the message is configured with lotsa plurality of next hop addresses, the message is forwarded to all the next hop addresses of next hops-after copied.

Said step c23 comprises:

c231. search the single broadcastunicast routing forwarding listtable and determine the type of exitegress interface corresponding to the next hop address;

c232. if the type of exitegress interface is NBMA (Non-Broadcast Multiple Access, i.e. point to multipoint), forward the message according to the exitegress interface;

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c233. if the type of ~~exit~~egress interface is broadcast, forward the message according to the next hop address in the ~~single-broadcast~~unicast routing forwarding ~~list~~table and set the property of the message as ~~single-broadcast~~unicast message;

C234. if the type of ~~exit~~egress interface is PTP (Point To Point), directly forward the message according to the next hop address ~~regulat~~specified in the multicast message forwarding rule.

Seen from ~~said~~ the above technical ~~scheme~~solution, in the present invention, the multicast message forwarding rule group designed for forwarding multicast message enables to flexibly configure the Access Control List (ACL) to realize the function of packet filter required by users, that is, to realize sending the multicast message in a multicast mode according to the interface ~~and users' requirement~~ or in a ~~single broadcast~~unicast mode according to the next hop address, as required by the users. The present invention has the following advantages in the control method of forwarding multicast message: first, in the present invention, the mode of sending message can be configured according to requirement and can effectively avoid efficiency loss caused by receiving a great deal of invalid multicast messages and the security risk which may be caused by efficiency loss; second, implementing the present invention does not need to configure IGMP on the host, which enables ~~to~~ more convenient use and management for users; third, in the present invention, a multicast message is forwarded ~~by configuring~~according to an established multicast message forwarding rule, such a configuration can replace functions of IGMP and the multicast routing protocol, therefore the number of various multicast protocol messages generated in the multicast network is

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greatly reduced and network bandwidth is saved.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig.1 is the structural diagram of the multicast network.

Fig.2 is the flowchart of concrete implementation according to the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENT

The method of forwarding multicast message in network communication according to the present invention can be both an independent mode of forwarding multicast message and an extension to the conventional mode of forwarding multicast message. In this method, a multicast message can be forwarded according to the specific multicast message forwarding rule designated by users but no longer search the multicast routing listtable only; the multicast message forwarding rule is the rule, regulatspecifying the mode of forwarding multicast message, confirmed and input by users according to their requirement. The present invention enables users to flexibly configure establish the multicast message forwarding rule according to requirement during networking, and provides great flexibility, expandability and good compatibility for users.

Embodiment of the present invention will be described according to Fig.2.

Step 1: Users configure establish the multicast message forwarding rule at the entryingress interface of corresponding router according to their requirement. The multicast message forwarding rule can contain only one rule or a multicast message forwarding rule group consisting of lotsa plurality of rules;.

One or lotsmore of multicast message forwarding rules can exist at a certain entryingress interface on the network device namely the router, every Every multicast

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message forwarding rule group is a relatively independent forwarding control policy, ~~regulat~~specifying necessary condition for forwarding multicast message according to corresponding multicast message forwarding rule~~,~~. ~~every~~Every message entering the router through this interface to be forwarded shall be ~~matched~~compared with the condition~~,~~. ~~if~~If the multicast message meets the description of a certain feature in the condition, that is, matches the condition, then the message is forwarded in ~~the~~a mode of forwarding multicast message corresponding to the condition~~,~~. ~~the~~The mode is in the multicast message forwarding rule, and the mode of forwarding multicast message in the multicast message forwarding rule describes in detail the forwarding scheme for the message and takes over the ~~following~~subsequent forwarding~~,~~.

Said necessary condition for multicast forwarding message according to the multicast message forwarding rule can be described with the source address information, destination address information or ~~entry~~ingress interface information in the multicast message, while the corresponding mode of forwarding multicast message in the multicast message forwarding rule can be described with ~~exit~~egress interface information or next hop address information in the multicast message~~,~~.

Step 2: ~~match~~compare the information~~, entering the router,~~ carried in the multicast message entering the router with corresponding information in the multicast message forwarding rule to determine mode of forwarding multicast message~~,~~.

After ~~configur~~establishing the multicast message forwarding rule at an interface of the router, all the multicast messages entering the router through the interface to be forwarded will be filtered and the multicast messages and multicast protocol messages reaching the

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local end will not be filtered; in the method of filtering: match all the multicast message

forwarding rules configuredestablished at the interface are compared with corresponding

information in the multicast message according toin an order of from the higher to lower

priority level designated in during establishingconfiguration;.

Step 3: determine whether there is multicast message forwarding rule matching with

the multicast message, if there is a multicast message forwarding rule matching the

multicast messageyes, process toperform step 4, otherwise process toperform step 5;.

During the process of filtering, if the multicast message matches with a certain

multicast message forwarding rule, stop the process of filtering and process toperform step

4; otherwise, go onproceed with the process of filtering, that is, to match compare the

multicast message with the next multicast message forwarding rule until all multicast

message forwarding rules match have been compared with the multicast message is;. if If

the multicast message does not match with any of the multicast message forwarding rules,

it will return to the normal flow of forwarding multicast to process, that is, to process

toperform step 5;.

Therefore, the present invention not only supports configurestablishing a multicast

message forwarding rule at the interface, but also supports configurestablishing several

multicast message forwarding rules at the interface;.

In the present invention, a certain multicast message forwarding rule can contain one

or lotsmore of modes of forwarding multicast message and can support different types of

modes of forwarding multicast message, for instance, there may exist configurations for the

an exitegress interface and the a next hop at the same time, therefore the present invention

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has ~~more~~ stronger function and more convenient application~~;~~.

Step 4: forward the message according to the matching multicast message forwarding rule~~;~~.

For configurations of different types of modes of forwarding multicast message, the present invention provides ~~the~~ forwarding mode~~s~~ ~~adapting~~ adapted to features of network to guarantee the security of forwarding multicast message in the network~~,~~. ~~now~~ Now implementation in different networks will be described as the following by taking an example of configuring ~~exit~~ egress interface and next hop~~:~~.

If ~~lots~~ a plurality of forwarding ~~exit~~ egress interfaces are configured in the mode of forwarding multicast message ~~of~~ according to ~~the~~ a multicast message forwarding rule, the message will be copied and forwarded to all designated interfaces. This mode provides the lowest security level for the multicast message forwarding~~;~~.

If ~~the~~ next hop IP addresses are configured in the mode of forwarding multicast message ~~of~~ according to ~~the~~ a multicast message forwarding rule, the local IP address therein will not be processed. For all valid opposite-end IP addresses, the ~~single broadcast~~ unicast routing ~~list~~ table will be searched. If there is no route, they will not be processed; if some route is found, they will be processed according to types of the ~~exit~~ egress interfaces in the routing items as follows:

if the type of the ~~exit~~ egress interface is NBMA (point to multipoint), forward the message according to the ~~exit~~ egress interface and virtual circuit therein;

if the type of the ~~exit~~ egress interface is broadcast (Ethernet)~~,~~ forward the message according to the next hop address found in the ~~single broadcast~~ unicast routing ~~list~~ table and

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set the property of the message as ~~single broadcast~~unicast message;

if the type of the ~~exit~~egress interface is PTP, forward the message directly according to the IP address configured in the policy routing, wherein the IP address acts as the next hop address;

if there is no ~~exit~~egress interface or next hop IP address configured, do not process the message and discard it directly~~;~~.

Users can choose from different configuring modes of multicast message forwarding rule according to different requirements for security level.

Step 5: forward the multicast message according to the multicast routing forwarding ~~list~~table~~, . detailed~~The forwarding process is the same as conventional one and will not be discussed here.

The multicast message forwarding rule ~~configured~~established in the present invention mainly works in IP layer and has no special requirements for the link layer protocol. Therefore, ~~configur~~establishing the rule can be based on kinds of link layer protocols such as Ethernet, PPP (Point-to-Point Protocol), ATM (Asynchronous Transfer Mode), Frame Relay, etc. and it is convenient for users.

For some small-scale or relatively fixed networks, only simple multicast message forwarding rule ~~can~~ need to be ~~configured~~established to control the multicast message forwarding to reduce extra cost in the system and to promote efficiency of forwarding and to effectively guarantee the security of forwarding multicast message.

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Please amend the Abstract as follows:

The ~~present~~ invention relates to a method of forwarding multicast message in network communication. In the method: first, ~~configure~~ establish forwarding match condition at the ~~entry~~ingress interface ~~to~~ of the network device ~~requiring~~ required to forwarding multicast message, the forwarding match condition ~~regulat~~specifies forwarding rule for the multicast message; then, ~~match~~ compare the multicast message to be forwarded to network device through the interface with the forwarding match condition, and forward the multicast message according to the ~~matching~~ comparing result. The ~~present~~ invention can configure the sending mode of messages according to requirement and can effectively avoid risks in security that may be caused by the broadcast mode for the multicast messages in the link layer as well as efficiency loss caused by receiving a great deal of invalid multicast messages, and the configuration is simple, and more convenient use and management is realized. In the present invention, forwarding multicast message ~~through configuring~~according to an established multicast message forwarding rule greatly reduces the number of various multicast protocol messages generated in the multicast network and saves bandwidth resource of network.